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EPHEMERIS.

1899 Gr. Mean Midnight.	app. α	app δ.	log Δ	Br.
October $8^{d}.5$	$16^{h}\ 41^{m}\ 13^{s}.9$	$-2^{\circ}\ 24'\ 8''$	0.3175	0.84
12 .5	46 45 .2	− 1 16 5	0.3340	
16 .5	52 11 .9	− 0 12 5	0.3495	
20 .5	57 34 .7	+ 0 48 34	0.3640	0.60

Brightness at the time of the first Mt. Hamilton observation is taken as unity.

Mr. ROGER SPRAGUE has independently computed the orbit from the same observations which he corrected for parallax and aberration on the basis of a first approximation.

ELEMENTS BY ROGER SPRAGUE.

$$T = 1899 \text{ July } 25.5208$$

$$\left.\begin{array}{l} i = 90^{\circ}\ 38'\ 22'' \\ \Omega = 279\ \ 47\ \ \ 0 \\ \omega = 327\ \ 53\ \ 50 \end{array}\right\} 1899.0$$

$$\log g = 0.130868$$

$$O - C:\ \Delta\lambda \cos\beta = -0''.8;\ \Delta\beta = +0''.3$$

UNIVERSITY OF CALIFORNIA, STUDENTS' OBSERVATORY.

PLANETARY PHENOMENA FOR NOVEMBER AND DECEMBER, 1899.

BY MALCOLM MCNEILL.

Mercury is an evening star throughout the month, and comes to greatest eastern elongation on the morning of November 16th. During the greater part of the month it sets at least an hour after sunset, and may be seen in clear weather. It is quite near several of the planets, and there are several interesting conjunctions. It moves away from the Sun until November 16th, passing *Mars* on November 4th, morning, distance 1° 48′, the Moon on November 4th, evening, with an occultation for some places, *Uranus* on November 8th, evening, distance 2° 37′, and as it returns toward the Sun after November 16th, it passes *Venus* on November 26th, morning, distance 0° 43′, and *Mars* again November 30th, evening, distance 0° 23′.

Venus is an evening star, increasing its distance from the Sun, so that toward the end of the month it sets an hour after sunset, and can be easily seen. It is in conjunction with *Uranus* on November 14th, distance 0° 24′, with *Mars* on November 16th, morning, distance 0° 11′, with *Mercury* November 26th, morning, distance 0° 43′, and with *Saturn* November 27th, afternoon, distance 1° 54′.

Mars is still closer to the Sun, its distance diminishing from 20°, on November 1st, to 13°, on November 30th. At the latter date it sets only forty minutes after sunset, and is too close to be seen without a good telescope. Its conjunctions with *Mercury* and *Venus* have already been noted. It will also be in conjunction with *Uranus* on the morning of November 13th, distance 0° 38′.

Jupiter is very near the Sun throughout the month, and moves from a point 10° east to a point 15° west, passing conjunction on the morning of November 13th. At the end of the month, it rises a little more than an hour before sunrise.

Saturn is still an evening star, but by the end of the month it sets only an hour after sunset, and it will not be easy to see. It is in the western part of *Sagittarius*, and moves about 6° eastward during the month.

Uranus is still nearer the Sun, and passes conjunction on the morning of November 30th, becoming a morning star.

Neptune is approaching opposition with the Sun, and rises shortly after sunset.

DECEMBER.

Eclipses.—There will be an *annular eclipse of the Sun* on December 2d, visible only in south polar regions, and also a *partial eclipse of the Moon* December 16th, the beginning visible generally throughout the eastern portion of North America, Europe, Asia, and Africa, and the ending generally throughout the whole of North America, South America, Europe, and Africa. The middle of the eclipse comes at 5^h 26^m P. M., Pacific time, and it will be practically total, less than one per cent. of the Moon's diameter remaining uneclipsed.

Mercury is an evening star at the beginning of the month, but passes inferior conjunction on December 5th, and becomes a morning star. Its distance from the Sun rapidly increases, and on December 11th it rises an hour before sunrise. It reaches greatest west elongation on the morning of December 25th, and then rises nearly two hours before sunrise. It can be easily seen in the morning twilight, on any clear morning during the latter half of the month.

Venus is an evening star, setting rather more than an hour after sunset on December 1st, and nearly two hours later on December 31st. It moves about 40° eastward during the month through *Sagittarius* into *Capricorn.*

Mars is still an evening star, but is too close to the Sun to be seen. Its distance from the Sun diminishes from 12° to 4°.

Jupiter is now a morning star, rapidly increasing its distance from the Sun. At the end of the month it rises three hours before sunrise. It moves westward 6° from *Libra* into *Scorpio*, and on December 31st it is distant from *β Scorpii* less than 1° to the west, and is moving toward that star.

Saturn is very close to the Sun, and passes conjunction on December 17th. By the end of the month it rises about an hour before sunrise, but it will not be easy to see.

Uranus is a morning star, 20° farther from the Sun than *Saturn* is; but it is too faint to be seen at the altitude it reaches before the morning twilight comes on.

Neptune is in opposition with the Sun on December 17th.

PHASES OF THE MOON, P. S. T.

		H. M.		H. M.
New Moon,	Nov. 3,	2 27 A.M.	Dec. 2,	4 48 P.M.
First Quarter,	Nov. 10,	5 35	Dec. 9,	1 3
Full Moon,	Nov. 17,	2 19	Dec. 16,	5 31
Last Quarter,	Nov. 24,	10 35 P.M.	Dec. 24,	7 57

THE SUN.

1899	R. A. H. M.	Declination. ° ′	Rises. H. M.	Transits. H. M.	Sets. H. M.
Nov. 1,	14 26	− 14 28	6 34 A.M.	11 44 A.M.	4 54 P.M.
11,	15 6	− 17 27	6 45	11 44	4 43
21,	15 47	− 19 57	6 57	11 46	4 35
Dec. 1,	16 30	− 21 50	7 7	11 49	4 31
11,	17 13	− 23 1	7 16	11 53	4 30
21,	17 58	− 23 27	7 23	11 58	4 33
31,	18 42	− 23 6	7 27	12 3 P.M.	4 39

MERCURY.

Nov. 1,	15 38	− 21 31	8 13 A.M.	12 56 P.M.	5 39 P.M.
11,	16 34	− 24 37	8 43	1 13	5 43
21,	17 18	− 25 24	8 51	1 17	5 43
Dec. 1,	17 15	− 23 11	7 58	12 34	5 10
11,	16 25	− 19 0	6 16	11 6 A.M.	3 59
21,	16 26	− 19 10	5 35	10 27	3 19
31,	17 10	− 21 45	5 49	10 31	3 13

VENUS.

Nov.	1.	15 14	− 17 46	7 34 A.M.	12 32 P.M.	5 30 P.M.
	11.	16 5	− 21 2	7 59	12 44	5 29
	21.	16 58	− 23 18	8 22	12 57	5 32
Dec.	1.	17 53	− 24 26	8 42	1 12	5 42
	11.	18 48	− 24 19	8 57	1 28	5 59
	21.	19 42	− 22 58	9 5	1 42	6 19
	31.	20 34	− 20 28	9 9	1 56	6 43

MARS.

Nov.	1.	15 46	− 20 20	8 15 A.M.	1 3 P.M.	5 51 P.M.
	11.	16 16	− 21 51	8 13	12 54	5 35
	21.	16 47	− 23 2	8 9	12 46	5 23
Dec.	1.	17 19	− 23 50	8 7	12 39	5 11
	11.	17 52	− 24 14	8 1	12 32	5 3
	21.	18 26	− 24 11	7 55	12 26	4 57
	31.	18 59	− 23 41	7 46	12 20	4 54

JUPITER.

Nov.	1.	15 4	− 16 26	7 18 A.M.	12 21 P.M.	5 24 P.M.
Dec.	1.	15 30	− 18 11	5 54	10 50 A.M.	3 46
Jan.	1.	15 57	− 19 37	4 24	9 15	2 6

SATURN.

Nov.	1.	17 21	− 22 3	9 57 A.M.	2 38 P.M.	7 19 P.M.
Dec.	1.	17 35	− 22 17	8 14	12 54	5 34
Jan.	1.	17 50	− 22 26	6 29	11 8	3 47

URANUS.

Nov.	1.	16 19	− 21 20	8 52 A.M.	1 36 P.M.	6 20 P.M.
Dec.	1.	16 26	− 21 38	7 3	11 46 A.M.	4 29
Jan.	1.	16 34	− 21 55	5 1	9 52	2 33

NEPTUNE.

Nov.	1.	5 46	+ 22 7	7 46 P.M.	3 5 A.M.	10 24 A.M.
Dec.	1.	5 43	+ 22 5	5 45	1 4	8 23
Jan.	1.	5 39	+ 22 4	3 36	10 55 P.M.	6 14

ECLIPSES OF *JUPITER'S* SATELLITES, P. S. T.

(Off left-hand limb as seen in an inverting telescope.)

		H. M.
III, D, Dec.	18.	4 1 A.M.
III, R,	18.	5 28
I, R,	19.	5 17

Jupiter is too near the Sun for observation of eclipses until the middle of December.